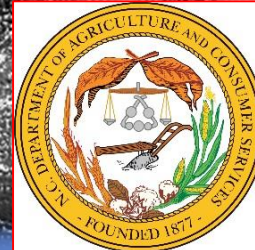
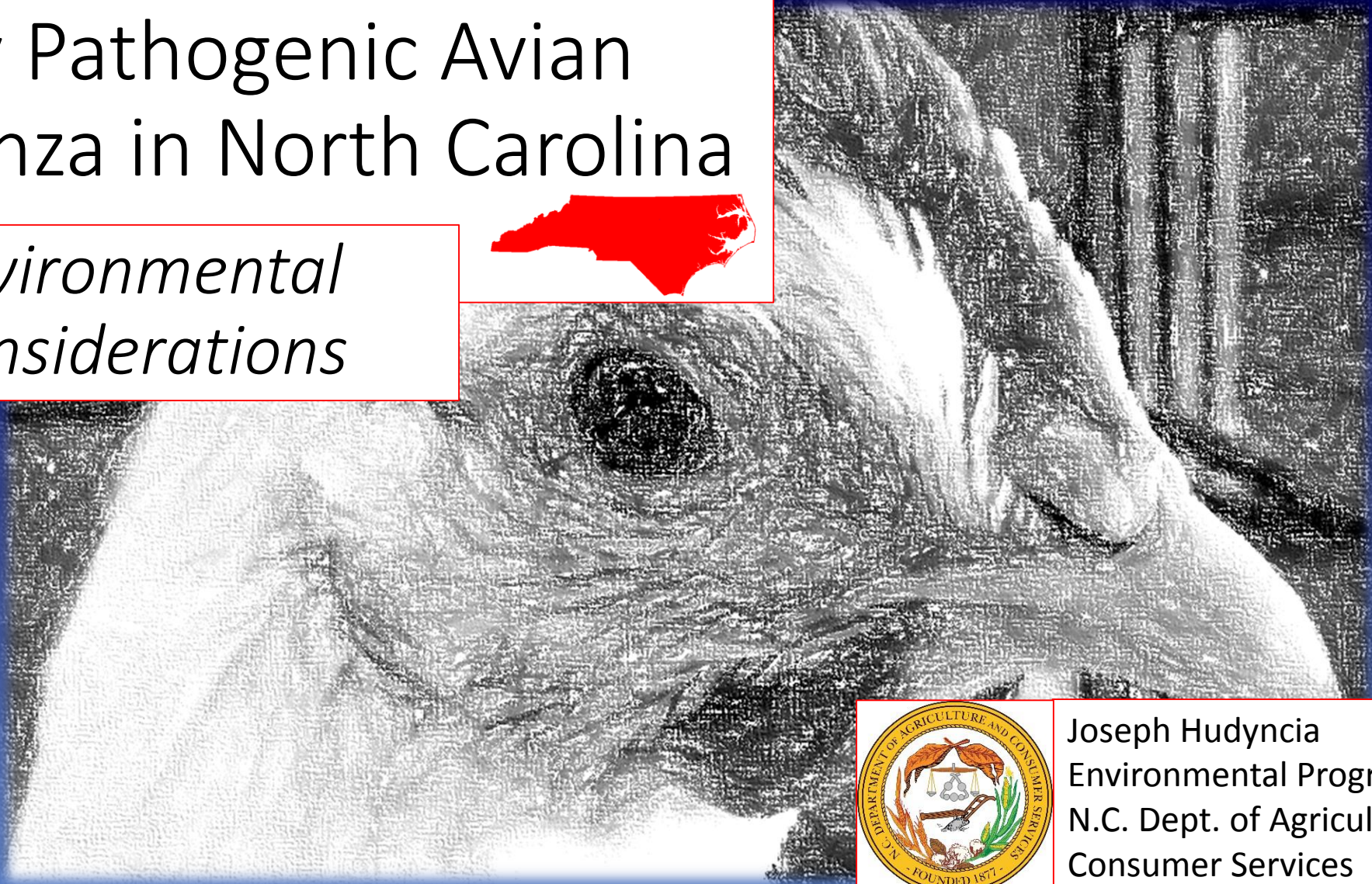


# Planning & Response to Highly Pathogenic Avian Influenza in North Carolina

## *Environmental Considerations*



Joseph Hudyncia  
Environmental Programs  
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Consumer Services

*The goals of an HPAI response are to (1) detect, control, and contain HPAI in poultry as quickly as possible; (2) eradicate HPAI using strategies that seek to protect public health and the environment, and stabilize animal agriculture, the food supply, and the economy; and (3) provide science- and risk-based approaches and systems to facilitate continuity of business for non-infected animals and non-contaminated animal products.*

*without the response effort causing more disruption and damage than the disease outbreak itself.*

# Need for Speed

*Surveillance and detection* → *action*

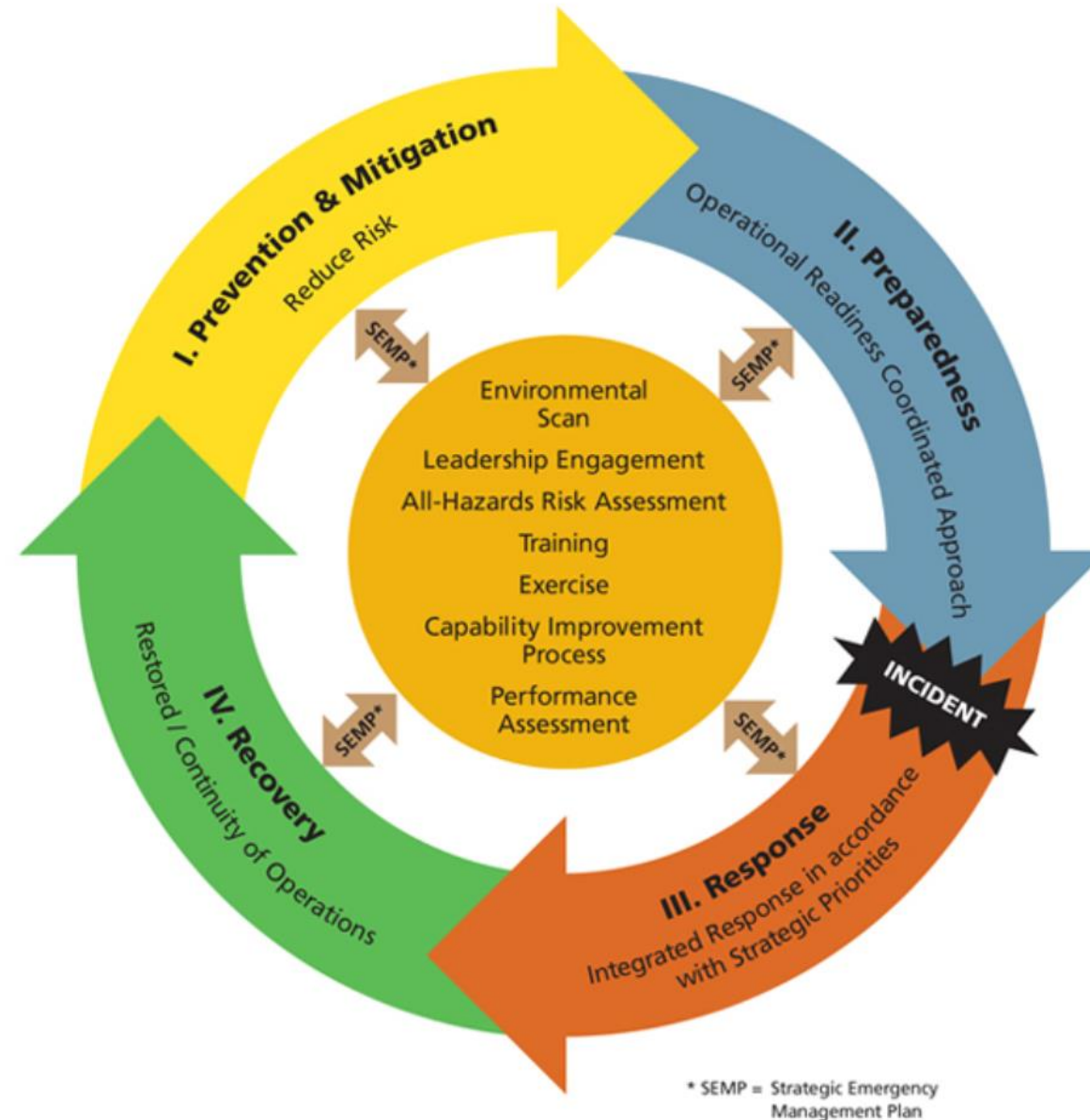


<http://www.storynory.com/2011/08/15/chicken-little/>

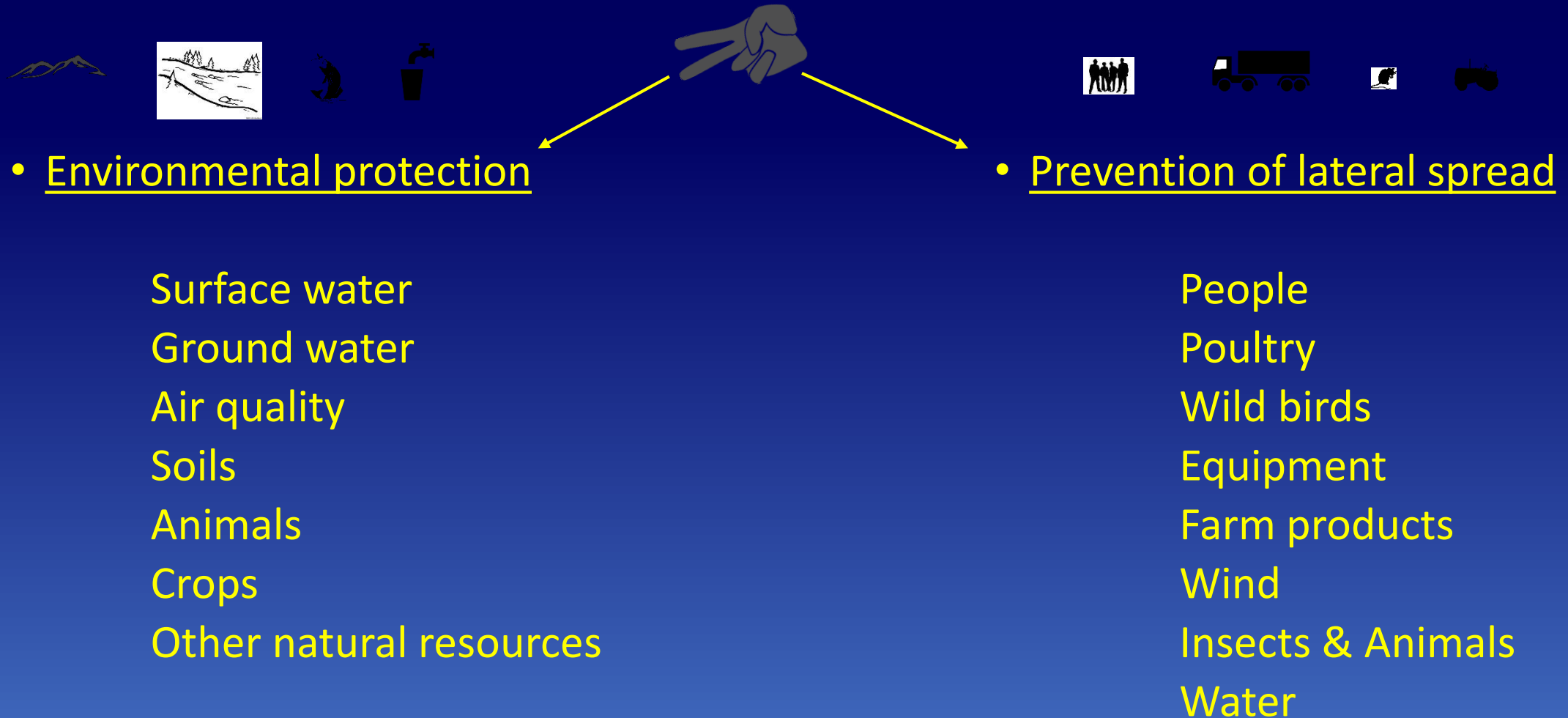
- Limit virus load to the surroundings and lateral spread
- Euthanize quickly
- Dispose of infected carcasses (inactivate virus)
- Limit opportunity for viral genetic changes, adaptation and endemic establishment
- Farm recovery and return to production
- Implications to international trade



## Emergency Management Continuum



# Environmental aspects of HPAI response:



# Examining the Legal, Regulatory, Policy Framework

- General Statute

  - Authority under Emergency declaration

- Administrative Code

  - Veterinary, DEQ Solid Waste, Water Quality, Air quality, etc.

- Guidance Documents

  - SART Document

  - DEQ HPAI Recommendations

- Policy

  - Agency (NRCS)

# Rules, Statutes, Policies, Standards

Disposal <sup>Mt.</sup> Burial  
Land app. Composter  
Re: Mass Mortality Incineration  
Land fill  
Rendering } Combo

Product  $\Rightarrow$  Mortality Disposal Tool (XLS)  
• calc = mortality volume  $\Rightarrow$  yd<sup>3</sup> burial volume

## Authorization Citations

- State Vet authority 02 52C .0102
- NRCS Standard (ref by rule)
- DENR Rule / permit
- NCGS 106-319 burial of mortality from transit (buried 2 ft)
- NCGS 106-403 - buried 3 ft
- NCAG opinion dated L.B. 1984 \*
- 02 52C .0102  $\Rightarrow$  April 1, 1984
- Local Health Dept.  $\Rightarrow$  GS 130A Articles 1-20
  - Mortality threatens human health
  - Article 10  $\Rightarrow$  drinking water

Disposal Mngt.

① Rendering  $\rightarrow$  GS 106.168.7

② Burial - GS 106-403 or other methods approved by State Vet  
(Disposal Pt)  
GS 106-549.7  
02 52C .0102  $\rightarrow$  3' burial from surface  
GS 130A Articles 1-10  $\rightarrow$  local health dept  
(Article 10  $\Rightarrow$  drinking water)  
15A NCAC 2L Ground water standards

③ On farm composting  $\Rightarrow$  15A NCAC 2T .0113(a)(12) deemed permitted  
as approved by state vet  $\neq$  discharge to surface water / GW  
15A NCAC 13B.1401 Solid Waste Permit

③a off site composting

④ Incineration 02 52C .0102  $\rightarrow$  complete incineration  
15 NCAC 02C .0107(a)(2)(J) Separation 500' from water supply well

⑤ Sanitary Landfill  $\rightarrow$  see transfer section

⑥ Transfer of materials

- Contaminated birds  $\neq$  movement 106-549.84 except permission by Ag Commissioner (litter & feed?)
- Class A compost transported off farm for sale or land app needs to follow 15 NCAC 02T.1109 O & M practices (includes testing, set back, reporting)
- Class B compost  $\rightarrow$  land app 15 NCAC 02T.1109

Land APP

15A NCAC 13B.1402 (g)(2) defines on farm composting and does not require permit  
Tied needs to explore "re-used on land owned land for associated w/farm (not offered to public) for emergency situation  
15A NCAC 02T.1106 (b)(3)(E)

15A NCAC 2T waste not discharged to surface water

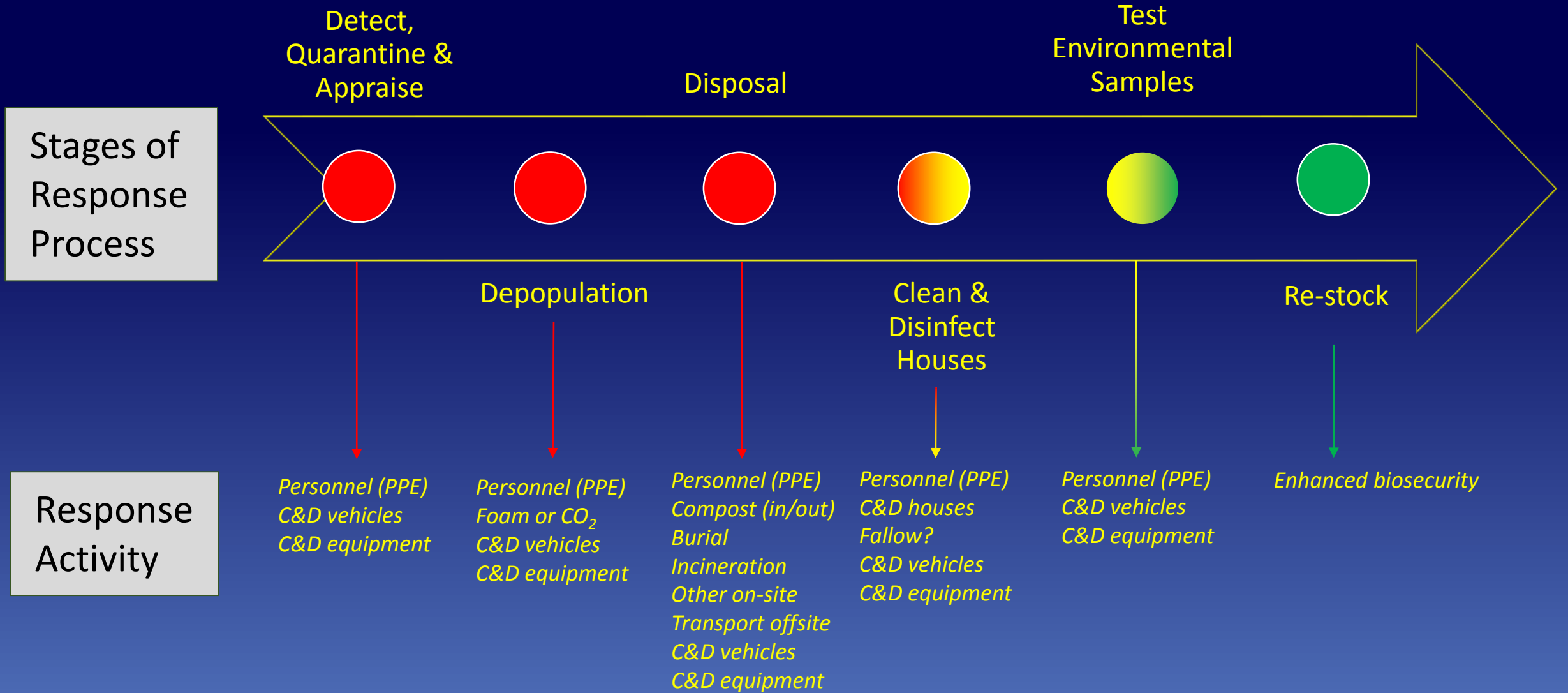
15A NCAC 2L Groundwater  
• 0107 Compliance Boundary  
• 0202 ground water quality standards  
Nitrate 10mg/L  
Zinc 1mg/L  
Copper 1mg/L

\* State vet referencing

15A NCAC 1T .0113(a)(12) deemed permitted for composting  
15A NCAC 18C .0203 public well water supplies  
15A NCAC 18C .0203 (h) 300ft from a cemetery or burial ground from public well water  
15A NCAC 2C - ground water construction rules  
GS 87-85(14) well definition  $\rightarrow$  standard for burial

Inconsistency in setbacks for private wells  
15 NCAC 02C .0107(a)(2) - where does burial & composting (?) come into play  
15 NCAC 02C (a)(2)(F) 100ft setback Re. other substances ground absorption within disposal system

15A NCAC 02T.1106  $\Rightarrow$  biological residuals / bio solid defin.  
15A NCAC 02T.1106 (b)(3)(E)  
24 NCAC .0203 (32)  
 $\rightarrow$  1995 version - did not make 2T rule  
\* considering mortality is a bio solid residual / bio solid  
Ag exception in 15A NCAC 2T .0113(a)(12) as deemed permitted





# NCDA&CS Equipment Decontamination Station Protocol uses a three-pronged approach to cleaning and disinfection:

- 1 – wash with soap, and
- 2 – high temperature water (160° F)
- 3 – disinfectant application



# Cleaning & Disinfection Agents

Rank in order of preference (aquatic toxicologist assessment):

- Sodium hypochlorite
- 5% citric acid
- Virkon <sup>TM</sup>
- Quaternary ammonia compounds?

## Recommendations:

- Dawn<sup>TM</sup> soap for initial wash
- citric acid w/  $\leq 1\%$  Phos Chek added as surfactant
- sodium hypochlorite & citric acid for disinfecting
- products w/ documented history for C & D; no long-term environmental effects
- known to be readily biodegradable
- Virkon <sup>TM</sup> degrades in soil environment; BMPs to protect surface water
- Quaternary ammonia – more data on aquatic toxicity & environmental persistence?



# Class A Firefighting Foam Phos-Chek™

- approved by USDA Forest Service & FDA
- used in the forest landscape for fire suppression > 40 yrs.
- active ingredients ammonium phosphate & diammonium sulfate in a 1% solution
- readily biodegradable
- low order of acute toxicity to fish and wildlife
- w/ minimal runoff poses little serious threat to aquatic life



# Disposal: *Must manage and dispose of more than just birds*

- Poultry carcasses
- Manure
- Litter
- Feed
- Eggs
- Shipping and packing materials





# Disposal Options

- Burial
- Rendering
- Landfill
- Incineration
- Alkaline hydrolysis
- Composting (in-house/outside house)
- Other (autoclave, heated drum, other)

# On-site Burial

## Pros

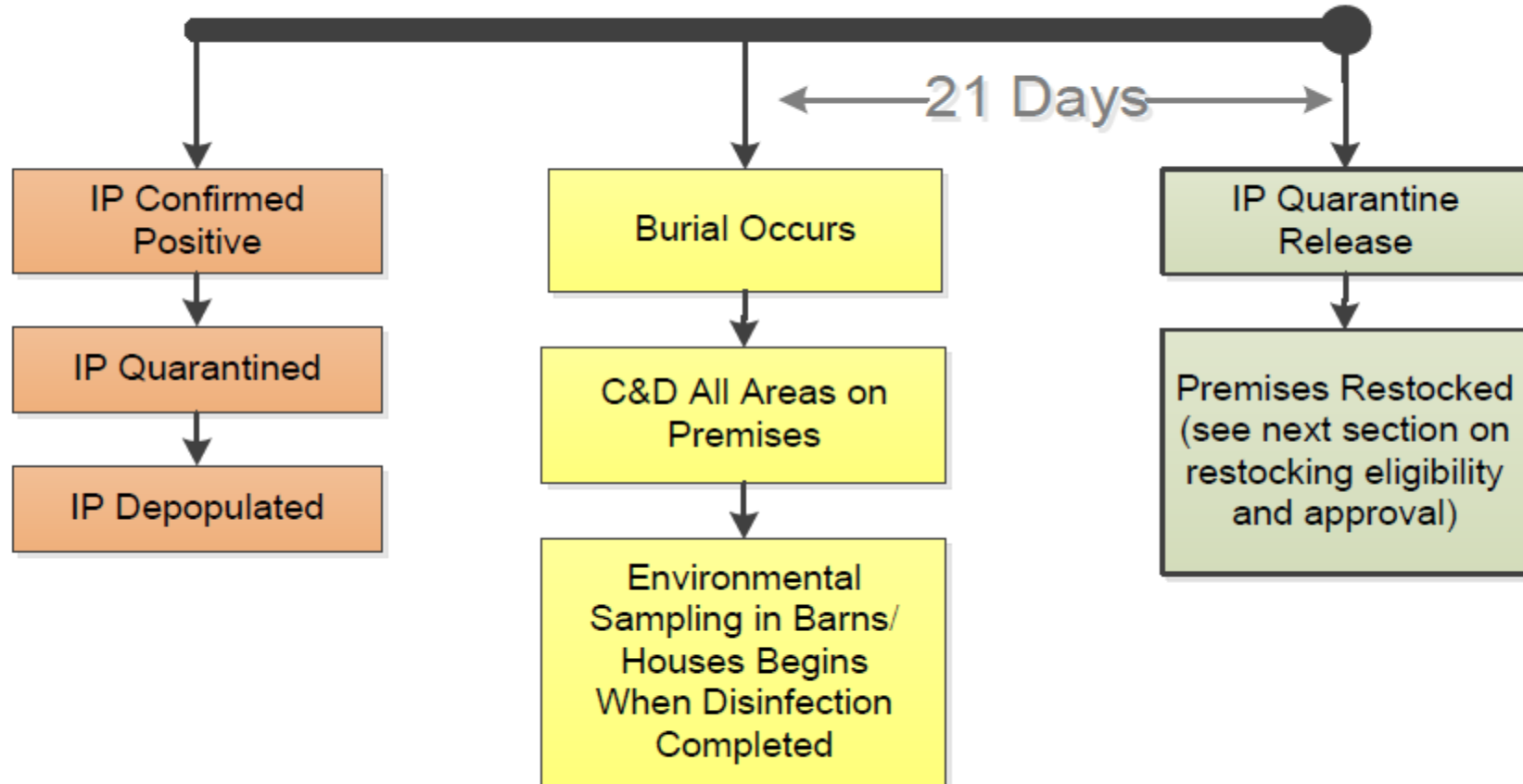
- Fast and 'easy'
- Inexpensive
- No off-farm transport of infected carcasses
- Equipment/operators readily accessible
- Process overseen by burial SME dispatched from Disposal IMT



## Cons

- Potential groundwater contamination
- Poultry carcasses degrade slowly in mass burial sites
- May impact future land use and property values
- Litter & feed can't be buried
- Sites may require environmental monitoring
- Virus survival unknown
- Potential to become the most expensive option (latent cost)

Figure 4. Timeline for Disposal & Premises Restocking: **BURIAL**



# Rendering

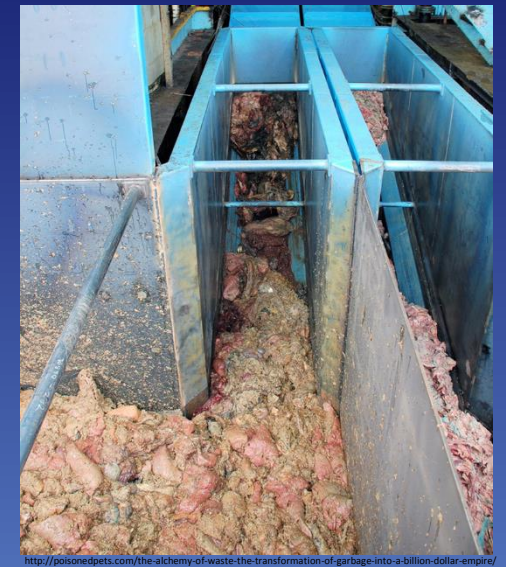
- High temperature process reduces carcasses to water, fat, meat, bone meal
- Material typically cooked at or above 100° C for minutes to > 1 hour



Photo: NRCS

Inactivation of AI in Meat		
	Temperature (°C)	Time
Poultry meat	60.0	507 seconds
	65.0	42 seconds
	70.0	3.5 seconds
	73.9	0.51 seconds

Source: OIE Terrestrial Animal Health Code, 2015.



<http://poisonedpets.com/the-alchemy-of-waste-the-transformation-of-garbage-into-a-billion-dollar-empire/>



# Rendering

## Pros

- Destroys the virus
- Unload and go (C&D)
- Option for large scale event
- Turns carcasses into usable product

## Cons

- High cost
- Biosecure transport needed
- Aerosolized virus must be managed
- Not suitable for all potentially infectious materials
- Disrupts rendering plant operations



# Landfill

- Engineered and highly managed earthen disposal on a large scale
- Operated under a solid waste permit
- Synthetic liner to isolate waste from the environment
- Added waste is covered daily



# Landfill

## Pros

- Easy (unload and go)
- No maintenance required
- Lined site protects groundwater
- Can contain and cover rapidly
- Stabilized, non-infectious material as daily cover?

## Cons

- Biosecure transport required (Bio-bags)
- Negative public perception
- Can be costly
- Biosecurity at site? PPE?
- Landfills have said 'no live virus'



# Incineration

- Commonly air curtain burners (fireboxes)
- Fuel source is wood logs
- Burns carcasses w/ forced air to accelerate process
- Process re-burns smoke particles to reduce size of particulate emissions
- End products is sterile ash (can be land-applied)





# Incineration

## Pros

- Destroys the virus
- Portable units
- Wood fuel typically available



## Cons

- Smoke emissions and air quality
- Limited throughput
- Birds do not burn well
- Requires trained and constant manpower
- Needs large amount of DRY wood fuel
- Not suitable for all potentially infectious materials (e.g. litter, manure, eggs)
- Costly to operate
- Permit?
- Public perception

# Alkaline hydrolysis

- Thermochemical process – uses heat and high pH
- Destroys the most difficult to kill pathogens
- End products are a protein-rich liquid and bones
- Liquid digestate can be land applied, added to compost, sent to a methane-generating landfill or digester, disposed of through municipal sewer system



# Alkaline hydrolysis

## Pros

- Effective at destroying all pathogens
- On-site management
- Scalable, modular units
- End-product can be land-applied as a fertilizer



## Cons

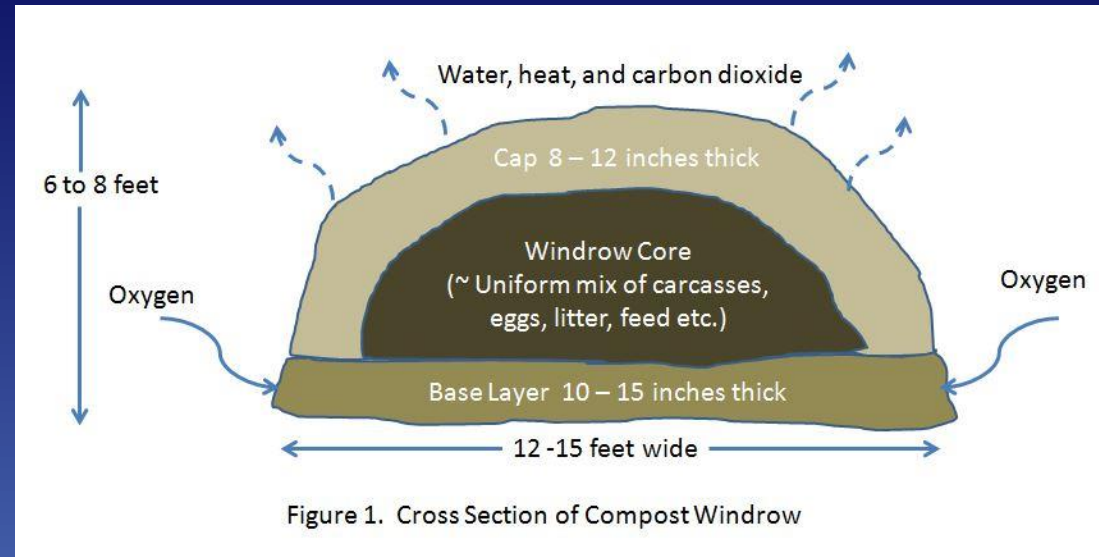
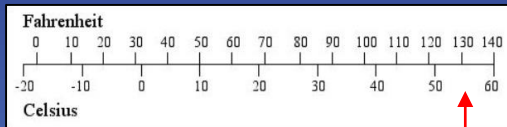
- Throughput limited
- Centralized processing requires biosecure transport
- Somewhat expensive
- Not suitable for all potentially infectious materials

# Composting – A ‘designed’ biological process

Composting uses controlled microbial activity to create ideal conditions to ‘kill’ the pathogen.

## Factors Directly Impacting Compost Microbial Activity

- Moisture
- Porosity (O<sub>2</sub> content)
- C:N ratio
- Particle size
- pH
- Temperature



*Establish windrows under the guidance of a Compost Subject Matter Expert (SME) dispatched from Disposal IMT*



# In-house Windrow Composting



## Pros

- The most biosecure disposal method (contained)
- Process inactivates the virus
- Accommodates all potentially infectious material (feed, litter, eggs, etc.)
- Produces useful end-product
- Minimizes risk to groundwater

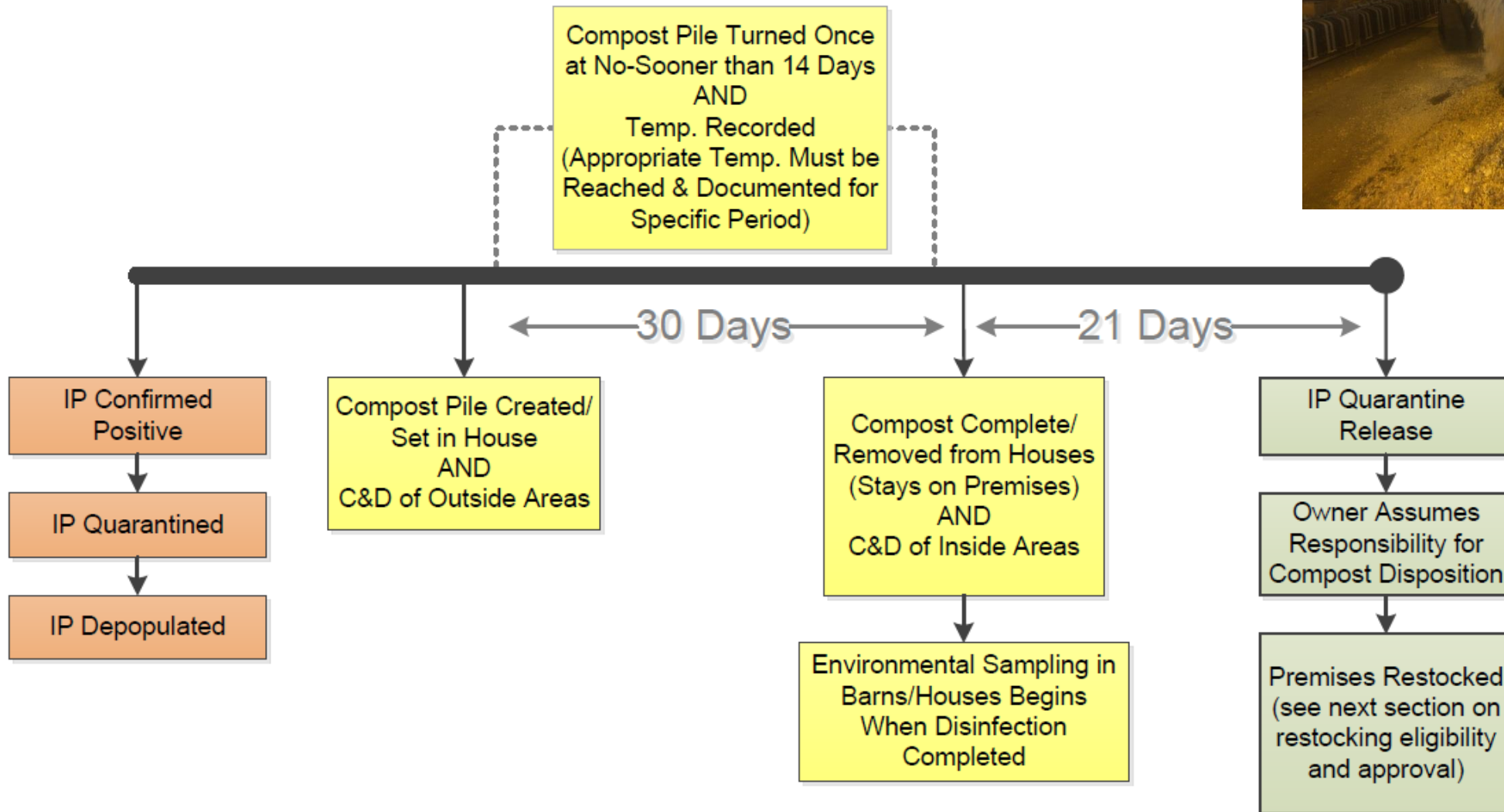


Photos by Flory & Peer, VA DEQ

## Cons

- Requires  $\geq 28$  days to complete; poultry house C&D is delayed
- Time and management (skilled)
- Off-site carbon material needed
- Carbon availability in a widespread event?
- C&D of transport trucks
- House designs may be difficult or prohibitive

Figure 1. Timeline for Disposal & Premises Restocking:  
**IN-HOUSE COMPOSTING**







CHORE TIME

WILLMAR POULTRY

FEE SLIT

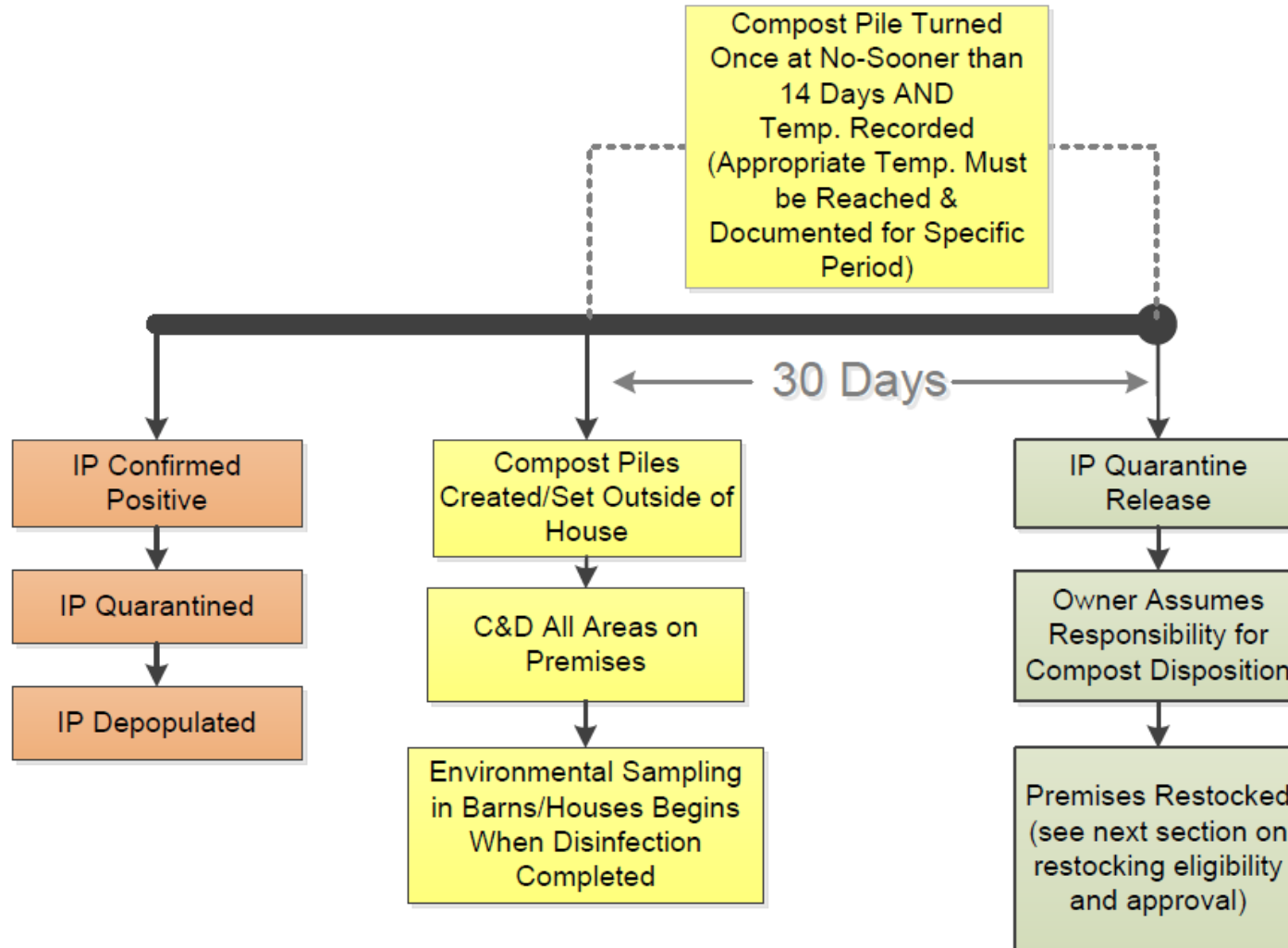
WPC  
DISEASE  
CONTROL  
AREA  
KEEP OUT

NO ENTRANCE  
WITHOUT  
AUTHORIZATION  
STOP  
HELP PROTECT BIRDS  
AND PEOPLE  
FROM DISEASE



Figure 2. Timeline for Disposal & Premises Restocking:

**OUTDOOR COMPOSTING**



- Siting to protect groundwater and surface water (not all sites suitable)
- Weather impacts to composting process
- Potential insect and animal vectors

# Finished Compost

Expected plant-available nutrients (lb/ton):  
(Broadcast) (N) 25, (P) 52, (K) 49

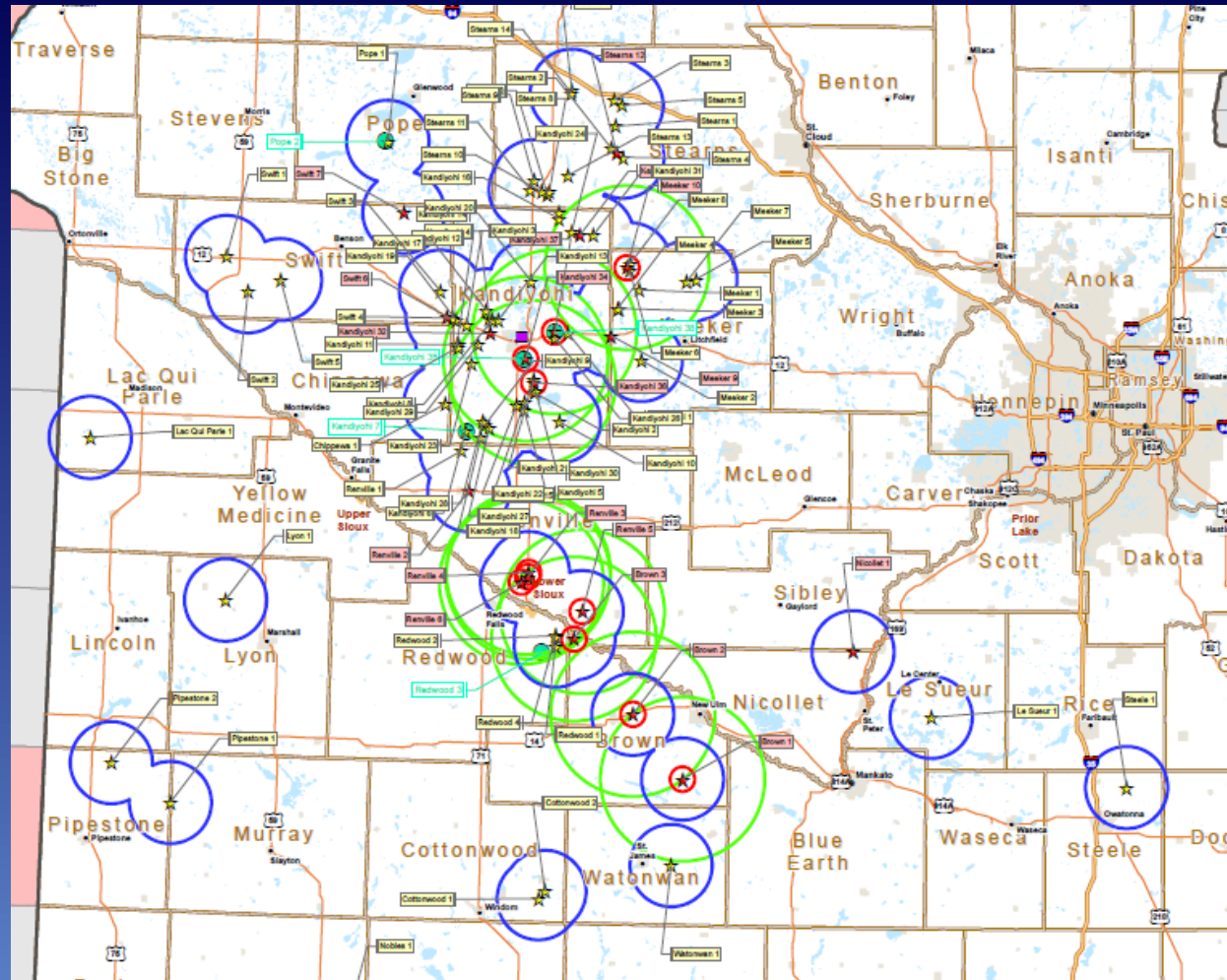


*A soil amendment with fertilizer value plus organic matter*

- Compost should be stockpiled and cured for several months
- Site properly to protect groundwater and surface water
- Used on agricultural land for crop or hay production
- Land apply to crops at agronomic rates
- Assistance w/ Nutrient Management Plans available through county Soil & Water Conservation District offices



*Ultimately all disposal options must remain on the table in order for the response to be scalable to a worst-case scenario.*



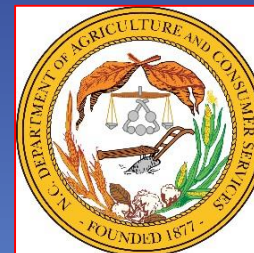
# Going forward:

- Stay up to date on newly validated solutions (disposal)
- Continue to build response capability and expertise
- Stay engaged with all partners
- If needed dispatch and do the right thing, i.e. respond rapidly and effectively while being environmentally protective



<http://www.buzzfeed.com/katienotopoulos/the-one-piece-of-chicken-safety-equipment-you-need-if-youre>

# Thank you...



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Environmental Programs  
N.C. Dept. of Agriculture &  
Consumer Services